

4 ENVIRONMENTAL EFFECTS

This section is the scientific and analytic basis for the comparisons of the alternatives. See table 1 in section 2.0 Alternatives, for summary of impacts. The following includes anticipated changes to the existing environment including direct, indirect, and cumulative effects.

4.1 GENERAL ENVIRONMENTAL EFFECTS

The performance of the CLA was simulated by using the South Florida Water Management Model (SFWMM v5.4.2). The SFWMM is a regional-scale, continuous simulation, hydrologic model that was developed and is maintained by the SFWMD. The SFWMM simulates the hydrology and water management of southern Florida from Lake Okeechobee to Florida Bay (Neidrauer, et al., 1998). The modeling results were the basis for comparison between the CLA alternative and the no action alternative (base). The environmental effects evaluation in this section is based on the simulation modeling results.

The proposed alternative (CLA) is a minor fine-tuning adjustment which, as demonstrated by simulation modeling, is expected to improve in-lake ecological benefits with minimal, if any, adverse impacts to the other lake management objectives. However, it is important to realize that any adjustment to the Lake Okeechobee regulation schedule may not be beneficial to all management purposes. While it is obvious that there would be benefits to some lake management performance areas, there may also be lesser benefits to other management objectives and purposes. A fundamental trade-off often exists among the multiple lake management objectives of Lake Okeechobee.

It is also important to state that while the CLA is an enhancement that improves the performance of WSE over the long term, it is important to look at the 36-year model output of the Lake Okeechobee stage hydrograph to see that although CLA is an improvement in many years, it cannot control the lake stage during very wet periods (**Figures 4, 5, and 6**). CLA does improve the ability to make releases at lower levels, while in Zone D, and there are years when this prevents the lake stage from rising into Zone C or Zone B. For example 1979 and 1980 (**Figure 5**) shows CLA reduces the amount of time in Zone C, and 1983 shows a reduction in the amount of time in Zone B. Although CLA shows an overall improvement, there are years when a rain event occurs late in the wet season, followed by a wetter than normal dry season, when the Lake Okeechobee stage may still rise into the higher regulatory zones; for example 1969-70 (**Figure 4**) and 1994-95 (**Figure 6**). Of

greatest benefit from CLA are the years when a reduction in the lake stage could help prevent a tropical or other rain event from causing the lake stage to rise above Zone D; for example 1966 (Figure 4), 1979-80 and 1982 (Figure 5) and 1993 (Figure 6).

4.2 VEGETATION

4.2.1 PROPOSED ACTION, CLASS LIMIT ADJUSTMENT

Lake Okeechobee

Modeling results (reference Water Resources Advisory Commission Lake Okeechobee Workshop in Appendix B, pages 22-24) indicate that the CLA alternative reduces the occurrence of lake stages above 17 feet compared to the base, and also improves the seasonal variation of lake stages. These responses are anticipated to have benefits for submerged aquatic plants in the lake's shoreline and littoral areas, and this in turn is expected to have benefits for fish that use those plant communities as essential spawning and foraging habitat. Increased submerged plant biomass also is known to be associated with improved water quality, because plants and their associated periphyton remove nutrients from the water, which lessens the risk of shoreline algal blooms (Haven, et al., 2004b).

St. Lucie

The St. Lucie Estuary performance was evaluated by counting the number of times during the 36-year (432 months) simulation that the average monthly flows to the estuary exceeded specific flow limits. The summary of the mean monthly flow envelope can be found below in **table 3**.

Table 3. St. Lucie Estuary Mean Monthly Flow Envelope Summary

Total inflows to SLE (basin runoff from C23,C24, C44, etc, plus LOK releases) (mean monthly cfs)	BASE (months)	CLA (months)	CLA-BASE (months)
< 350 cfs (less is better)	136	129	-7 (better)
350-2000 cfs (more is better)	231	235	+4 (better)
2000-3000 cfs (less is better)	33	40	+7 (worse)
> 3000 cfs (less is better)	32	28	-4 (better)

Source: SFWMD Technical Report (Appendix B)

As table 3 indicates, there is an increase in the moderate discharges to the St. Lucie Estuary. When low to moderate releases are done over a longer time-frame and in an estuarine-sensitive manner, then there may be some avoidance of the

higher damaging discharges. Under the CLA action, there would be slightly less damaging discharges greater than 3,000 cfs (4 less than the base, or no action alternative). The simulation results do not indicate any adverse impact to oysters for the St. Lucie Estuary.

Caloosahatchee River Estuary

The Caloosahatchee Estuary performance was evaluated by counting the number of times during the 36-year (432 months) simulation that the average monthly flows to the estuary exceeded specific flow limits.

Table 4. Caloosahatchee Estuary Mean Monthly Flow Envelope Summary

Inflows to CE at S-79 (C43 basin runoff plus LOK releases) (mean monthly cfs)	BASE (months)	CLA (months)	CLA-BASE (months)
< 300 cfs (less is better)	156	149	-7 (better)
300-2800 cfs (more is better)	207	207	0
2800-4500 cfs (less is better)	37	42	+5 (worse)
> 4500 cfs (less is better)	32	34	+2 (worse)

Source: SFWMD Technical Report (Appendix B)

The results of the CLA simulation for the Caloosahatchee are difficult to evaluate. The modeled differences are small. As compared to the base case, the CLA simulation shifts 7 months from the low flow category to the moderate and high flow categories. This represents a change of 1.6% (7 of 432 months). The additional seven months of discharge (> 2800 cfs) would have adverse effects on seagrasses in the lower more marine end of the estuary. On the other hand, the seven fewer months of flows below 300 cfs would benefit tape grass beds, *Vallisneria americana*, in the upper brackish region of the estuary. These beds are sensitive to high salinity events caused by intrusion of ocean water. These intrusions occur when flows fall below 300 cfs at the Franklin Lock and Dam. The decrease in low flows (<300 cfs) versus the increase in moderate to high flows (> 2800 cfs) could potentially offset each other. Since the modeled differences are small and potentially offsetting, neither benefits or adverse impacts could be determined.

4.2.2 NO ACTION ALTERNATIVE (STATUS QUO)

Tables 3 and 4 compare the mean monthly flows with the no action alternative (base) and with the CLA alternative. A key feature of the WSE schedule is the lower operational zone, labeled Zone D (**reference Figure 7**). This zone allows the operational flexibility to release water to the Everglades Water Conservation Areas (WCAs) and estuaries, to lower lake water levels, which minimizes adverse impacts

to the lake's littoral zone. If very wet conditions exist or are expected over the next six months, releases to the WCAs and pulse releases to tidewater are initiated in Zone D (**Figures 2, 3 and 7**). However, since the first releases made under WSE, in July 2002, it has been observed that the schedule called for no releases to the estuaries during a long period from February to June 2003. As documented in **Appendix B** (SFWMD technical report), the lake stage at the beginning of the 2003 wet season was approximately 14.6 ft. NGVD (in the middle of Zone D). August and September inflows pushed the lake stage into Zone C and for a short period of time into Zone B. To regulate the high lake stage, large damaging discharges to both estuaries were required. If a moderately high lake stage exists when a seasonal net inflow forecast prompts WSE to make no lake releases prior to the wet season, then a higher lake stage is the result, which can be detrimental to the lake's vegetation. **Appendix B** goes into more detail comparing the no action alternative with the CLA alternative.

It is important to state that the WSE (no action alternative) schedule was adopted in 2000 because it appeared to provide substantial benefits for Lake Okeechobee's littoral zone and marsh. In its short existence, the WSE has demonstrated much better performance as compared with the previous regulation schedule, Run 25. However, there have been several opportunities when water managers desired to make releases to tidewater, but the decision tree did not lead to that action. Low-level pulse releases would have provided relief to Lake Okeechobee's shoreline vegetation and littoral zone **without causing adverse effects** to downstream estuaries.

4.3 THREATENED AND ENDANGERED SPECIES

4.3.1 PROPOSED ACTION, CLASS LIMIT ADJUSTMENT

The CLA action improves in-lake performance. As such, there would be a potential benefit to listed species, such as the Okeechobee Gourd, where a lower lake stage is crucial for its survival. This action would not adversely impact threatened or endangered species under the jurisdiction of the USFWS or National Marine Fisheries Service (NMFS).

4.3.2 NO ACTION ALTERNATIVE (STATUS QUO)

The USFWS concluded during coordination of the WSE that expected improvements on habitat conditions due to WSE would likely benefit the Okeechobee gourd, bald eagle, wood stork, and the Everglades snail kite in the vicinity of Lake Okeechobee (USACE, 2000a). This alternative would not adversely impact endangered or threatened species under the jurisdiction of the USFWS or the NMFS.

4.4 FISH AND WILDLIFE RESOURCES

4.4.1 PROPOSED ACTION, CLASS LIMIT ADJUSTMENT

Lake Okeechobee

As was the conclusion with vegetation (4.2.1) the effects of the CLA are expected to be beneficial to the fish and wildlife resources of Lake Okeechobee. Compared to the base, or no action alternative, the CLA alternative would reduce the occurrence of lake stages above 17 ft. and also improve the seasonal variation of lake stages. These responses would benefit aquatic plants in the lake's shoreline and littoral zone areas, which would be a benefit for fish and wildlife using those plant communities for spawning and foraging habitat.

Caloosahatchee and St. Lucie Estuaries

Estuarine scientists from the SFWMD are, and would continue to be, consulted to determine the needs of the Caloosahatchee River Estuary and St. Lucie River Estuary prior to releases to tidewater and to determine the status of the individual estuarine ecosystems. Decisions regarding timing of releases and amount (level of release) would be determined based on the status of the individual estuarine ecosystems, as well as consideration of local runoff contributions.

The CLA simulation results have shown that CLA nearly doubles (from 17% to 34%) the amount of time releases to the estuaries are made when in Zone D. Even though there would be an increase in the number of pulse releases to the estuaries, the increased flow to the estuaries does not necessarily indicate the performance of the estuaries is adversely affected. Estuaries can also be impacted by high salinity, especially during the dry periods. Some of the increased flow as a result of the CLA occurs during the dry periods when the estuaries would benefit from the low-level pulse releases. During these times, the estuaries may benefit from freshwater releases to attain the preferred salinity envelope.

The SFWMD estuary staff use oysters as indicator species for the health of the St. Lucie Estuary. In particular, flow and salinity envelopes are based on the salinity requirements of the American oyster (*Crassostrea virginica*). When estuary flows are too low and salinities are high, adult oysters are more susceptible to marine predators and to parasitic infections. At high estuary flows, oysters are progressively stressed physiologically by declining salinity.

Oysters can tolerate salinities resulting from flows in the 350 to 2,000 cfs range. In the 2,000 – 3,000 cfs range, oysters become stressed by low salinity and at flows above 3,000, mortality can occur. At flows below 350 cfs, salinity increases

in the St. Lucie and oysters are more susceptible to marine predators and parasitic infections.

In the Caloosahatchee SFWMD staff use the condition of submerged grass beds as indicators of ecosystem health. Beds of tape grass, *Vallisneria americana*, located near the head of the estuary are sensitive to high salinity. Damaging salinities occur when monthly average discharge at the Franklin Lock and Dam falls below 300 cfs. At the mouth of the estuary, seagrasses, such as shoal grass, *Halodule wrightii*, prefer marine conditions. High discharges (> 2800 cfs) lower salinity and damage these beds. Flows in the range between 300 and 2800 cfs result in salinity conditions that are tolerable for both type of grass.

The CLA improves the likelihood of making smaller releases more often, as opposed to stressful high damaging estuary releases. Smaller releases are preferred because the higher volume releases can have adverse effects to estuarine biota. The CLA would allow water managers to have the enhanced flexibility to allow for more environmentally sensitive management of discharges to the estuaries. Reference section 4.5.1 for more detail. Additionally, more information on estuary performance for the CLA alternative can be found in **Appendix B**.

4.4.2 NO ACTION ALTERNATIVE (STATUS QUO)

The no action alternative and its effects on fish and wildlife resources would be similar to the effects on vegetation (reference section 4.2.2). High discharges result in high volumes of water that forces saline water out of the estuaries. It has been well documented (Chamberlain and Doering 1998a, 1998b and 1999; Mozzotti, *et al.* 2003;) that an optimum range of freshwater inflow is necessary for the survival of many estuarine fish, ichthyoplankton, zooplankton, and invertebrates. Species that are considered indicator organisms for estuarine health, such as oysters, could be disrupted during their reproductive stage by drastic changes to salinity.

4.5 ESSENTIAL FISH HABITAT

4.5.1 PROPOSED ACTION, CLASS LIMIT ADJUSTMENT

Adverse impacts to essential fish habitat from the proposed action are not expected. When the WSE regulation schedule requires that water must be released from the lake to the estuaries, technical experts on estuarine ecology will provide scientific input with regard to the effects of various discharge volumes. On a weekly or more frequent basis, water managers and scientific staff review results from decision trees in the WSE regulation schedule to determine the amounts of water to release from Lake Okeechobee. Estuary conditions, including estuary salinity ranges and biological indicators, are discussed and considered prior to water

releases. Implementing the CLA to the WSE will not change any of these parameters. The CLA will allow for lower to moderate pulse releases in an estuarine-sensitive manner and potentially reduce the need for high level regulatory releases that could adversely impact estuarine biota. Additional information on vegetation and fish and wildlife resources can be found in Sections 4.2.1 and 4.4.1.

The proposed action is completely operational, and no structural features, construction, modification of existing structures, or land acquisition is being proposed. This action will not adversely affect essential fish habitat or the species managed by the South Atlantic Fishery Management Council (SAFMC).

4.5.2 NO ACTION ALTERNATIVE (STATUS QUO)

Reference section 4.2.2 and 4.4.2.

4.6 HISTORIC PROPERTIES

The State Historic Preservation Officer (SHPO) indicated that no significant archaeological or historical resources are recorded within the project area (reference letter dated May 21, 2004, *Appendix C*). As such, there would be no affect to historic properties.

4.7 SOCIO-ECONOMIC

The primary land use surrounding Lake Okeechobee is agriculture. Sugar cane plantations, cattle ranching, citrus, vegetable production and ornamental nurseries make up the majority of agriculture land use in this area.

Recreational and sport fishing, along with commercial fishing, are major activities associated with Lake Okeechobee, which brings revenues to the marinas, fishing guides, hotels, and support industries around the lake. Lake Okeechobee also provides a wide variety of water and land based recreation including boating, airboating, picnicking, camping hunting, and hiking along the Lake Okeechobee Scenic Trail.

A full economic evaluation was completed for the WSE as part of the EIS documentation. The evaluation focused on agricultural and urban water supply, recreation, navigation, and commercial fishing. As indicated in the evaluation, potential adverse effects on the economy are not anticipated. As such, it is unlikely that the proposed operational change to the WSE would result in any significant economic change.

The St. Lucie and Caloosahatchee Estuaries also contribute significantly to the regional and state economy. No adverse socio-economic impacts to the estuary regions are anticipated by the proposed action.

4.8 AESTHETICS

The proposal would not adversely impact this value. The nature of this action is not visible or impacting to area aesthetics.

4.9 RECREATION

The proposed action would not adversely affect recreation.

4.10 WATER SUPPLY

The CLA performance relative to water supply is described in detail in *Appendix B*. Water supply performance of the CLA is not expected to significantly change compared to the base, or no action alternative. The CLA would not adversely impact water supply performance.

4.11 NAVIGATION

This action would not impede navigation through the Okeechobee Waterway or the Intracoastal Waterway.

4.12 WATER QUALITY

Potential benefits anticipated in shoreline areas of the lake where submerged plants occur. Water quality conditions in the estuaries may have a positive affect on salinity due to the potential increase in low-level releases from the lake during dry periods.

4.13 FLOOD PROTECTION

To evaluate flood protection of the preferred alternative, CLA, reference figure 11 in the SFWMD Technical Report in Appendix B. Figure 11 shows a performance measure that compares the maximum lake stage and the number of days the stage exceeds 16.5 ft, NGVD, during the beginning of the peak of the hurricane season. As compared to the base, the CLA simulation lowers the peak stage by over 0.55 ft., and reduces the number of days above 16.5 ft. from 17 to 3 (SFWMD Technical Report, *Appendix B*).

4.14 WATER CONSERVATION AREAS (WCA)

Several measures of performance for the Water Conservation Areas (WCAs) were evaluated by SFWMD staff. Hydroperiod differences relative to the National System Model were for the most part, not affected by CLA (reference **Appendix B** for more detail). However, there was a slight improvement, an extended hydroperiod, in Northern WCA-3A with the CLA alternative. CLA produced improved habitat suitability for wading birds relative to the Base (SFWMD Technical Report, **Appendix B**).

4.15 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

A preliminary assessment indicated no evidence of hazardous, toxic or radioactive waste (HTRW) affecting this action.

4.16 AIR QUALITY

Due to the operational nature of this action, there would be no affect on air quality.

4.17 NOISE

With the implementation of the proposed action, there would be no affect on existing or future noise levels.

4.18 NATIVE AMERICANS

No impact to Native American resources.

4.19 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

An irreversible commitment of resources is one in which the ability to use and/or enjoy the resource is lost forever. One example of an irreversible commitment might be the mining of a mineral resource. An irretrievable commitment of resources is one in which, due to decisions to manage the resource for another purpose, opportunities to use or enjoy the resources as they presently exist are lost for a period of time. An example of an irretrievable loss might be where a type of vegetation is lost due to road construction.

As there is no proposed construction or alteration of existing features or landscape, there would be no irreversible or irretrievable commitment of resources as a result of this action.

4.20 COMPATIBILITY WITH FEDERAL, STATE, AND LOCAL OBJECTIVES

This action is compatible with Federal, State, and local objectives.

4.21 CONFLICTS AND CONTROVERSY

There are no unresolved issues. Concerns expressed by commenting Federal, State, and local governments and interested groups will be addressed in the final environmental assessment.

4.22 CUMULATIVE IMPACTS

The preferred alternative proposes no adverse impact to protected species, water quality, water supply or natural resources. The changes proposed by the CLA are minor and relatively easy to implement. The increased flexibility to implement this action will provide benefits to Lake Okeechobee without adversely impacting the performance of other lake management objectives.

4.23 COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS

4.23.1 NATIONAL ENVIRONMENTAL POLICY ACT OF 1969

Environmental information on the project has been compiled and this Environmental Assessment has been prepared. The project is in compliance with the National Environmental Policy Act.

4.23.2 ENDANGERED SPECIES ACT OF 1973

Consultation will be initiated with National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) by circulation of this EA. This action will be fully coordinated under the Endangered Species Act and will be in full compliance with the Act.

The Corps has determined that listed species and their critical habitat under jurisdiction of the USFWS and the NMFS are not likely to be adversely effected as a result of this action.

4.23.3 FISH AND WILDLIFE COORDINATION ACT OF 1958

During the Lake Okeechobee Regulation Schedule Study, the WSE schedule was coordinated with the U.S. Fish and Wildlife Service (USFWS). As a result of the coordination, a Fish and Wildlife Coordination Act Report (CAR) dated October 1999 was prepared and submitted by the USFWS. The preferred action (CLA) in this EA falls within the scope of the existing CAR. As such, the 1999 CAR will

apply to the temporary deviation. This EA will be coordinated with the USFWS for comment. The proposed action is in compliance with the Act.

4.23.4 NATIONAL HISTORIC PRESERVATION ACT OF 1966 (INTER ALIA)

(PL 89-665, the Archeology and Historic Preservation Act (PL 93-291), and executive order 11593) Consultation with the Florida State Historic Preservation Officer (SHPO), has been conducted in accordance with the National Historic Preservation Act, as amended; the Archeological and Historic Preservation Act, as amended and Executive Order 11593. SHPO consultation was initiated April 8, 2004. In a May 21, 2004 response, the SHPO indicated that no significant archaeological or historical resources are located within the project area. The project will not affect historic properties included in or eligible for inclusion in the National Register of Historic places. The project is in compliance with each of these Federal laws.

4.23.5 CLEAN WATER ACT OF 1972

The proposed action is in compliance with this act. As the proposed action is strictly of an operational nature, and does not involve any construction activity, water quality certification from the State of Florida is not required. Furthermore, as there are no structural components contained in the proposed action and no dredge and fill operations being considered, a Section 404(b) Evaluation is not appropriate.

4.23.6 CLEAN AIR ACT OF 1972

No air quality permits would be required for this action.

4.23.7 COASTAL ZONE MANAGEMENT ACT OF 1972

A federal consistency determination in accordance with 15 CFR 930 Subpart C is included in this report as *Appendix C*. State consistency review will be performed during the coordination of the draft EA and the State will determine if the project is consistent with the Florida Coastal Zone Management Program.

4.23.8 FARMLAND PROTECTION POLICY ACT OF 1981

Project activities will not affect agriculture lands within the project area. The proposed action recommends a temporary deviation to the existing lake regulation schedule and will not impact existing or future agricultural or associated urban water supply. This act is not applicable.

4.23.9 WILD AND SCENIC RIVER ACT OF 1968

The Northwest Fork of the Loxahatchee River is designated a Wild and Scenic River. This resource is not expected to be adversely impacted by the proposed action. The study is in full compliance with this act.

4.23.10 MARINE MAMMAL PROTECTION ACT OF 1972

The proposed action is operational and does not involve construction activities; there would not be any adverse impact to marine mammals in the area. Therefore, this action is in compliance with the Act.

4.23.11 ESTUARY PROTECTION ACT OF 1968

The Indian River Lagoon and Charlotte Harbor are part of the National Estuary Program established by Section 320 of the Clean Water Act. This action would not adversely affect these estuaries. As such, the action is in compliance with this Act.

4.23.12 FEDERAL WATER PROJECT RECREATION ACT

The effects of the proposed action on outdoor recreation have been considered. Benefits to fishing, boating and wildlife viewing should be accrued by implementation of the proposed action. Therefore, the action is in compliance with this act.

4.23.13 FISHERY CONSERVATION AND MANAGEMENT ACT OF 1976

This action is being coordinated with the National Marine Fisheries Service (NMFS) and will be in compliance with the act.

4.23.14 SUBMERGED LANDS ACT OF 1953

The project would occur on submerged lands of the State of Florida. The project has been coordinated with the State and is in compliance with the act.

4.23.15 COASTAL BARRIER RESOURCES ACT AND COASTAL BARRIER IMPROVEMENT ACT OF 1990

There are no designated coastal barrier resources in the project area that would be affected by this project. These acts are not applicable.

4.23.16 RIVERS AND HARBORS ACT OF 1899

The proposed work would not obstruct navigable waters of the United States. The project is in full compliance.

4.23.17 ANADROMOUS FISH CONSERVATION ACT

Anadromous fish species would not be affected. The project has been coordinated with the National Marine Fisheries Service and is in compliance with the act.

4.23.18 MIGRATORY BIRD TREATY ACT AND MIGRATORY BIRD CONSERVATION ACT

No migratory birds would be affected by project activities. The project is in compliance with these acts.

4.23.19 MARINE PROTECTION, RESEARCH AND SANCTUARIES ACT

This act is not applicable. Ocean disposal of dredged material is not proposed as a part of the proposed action.

4.23.20 MAGNUSON-STEVENSON FISHERY CONSERVATION AND MANAGEMENT ACT

Coordination of this Environmental Assessment (EA) constitutes initial consultation with the National Marine Fisheries Service under provisions of this Act. Based on analysis discussed in this EA, the Corps has determined that the proposed action would not adversely affect the essential fish habitat of species managed under this Act.

4.23.21 E.O. 11990, PROTECTION OF WETLANDS

No wetlands would be affected by project activities. This project is in compliance with the goals of this Executive Order.

4.23.22 E.O. 11988, FLOOD PLAIN MANAGEMENT

The project is in the base flood plain (100-year flood) and has been evaluated in accordance with this Executive Order. Project is in compliance.

4.23.23 E.O. 12898, ENVIRONMENTAL JUSTICE

The proposed action would not result in adverse health or environmental effects. Any impacts of this action would not be disproportionate toward any minority. The activity does not (a) exclude persons from participation in, (b) deny persons the benefits of, or (c) subject persons to discrimination because of their race, color, or

national origin. The activity would not impact "subsistence consumption of fish and wildlife".

4.23.24 E.O. 13089, CORAL REEF PROTECTION

The proposed action would not result in adverse impacts to coral reef ecosystems. No coral reef habitats exist within or near the project area. This act is not applicable.

4.23.25 E.O. 13112, INVASIVE SPECIES

This action does not authorize, fund, or carry out action that might spread or introduce invasive species.